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THE IRON ORES OF THE SOUTH MOUNTAIN

ALONG THE LINE OF THE HARRISBURG AND POTOMAC RAILWAY, IN
CUMBERLAND COUNTY, PENNSYLVANIA.*(Read before the American Philosophical Society, January 3, 1873.)*

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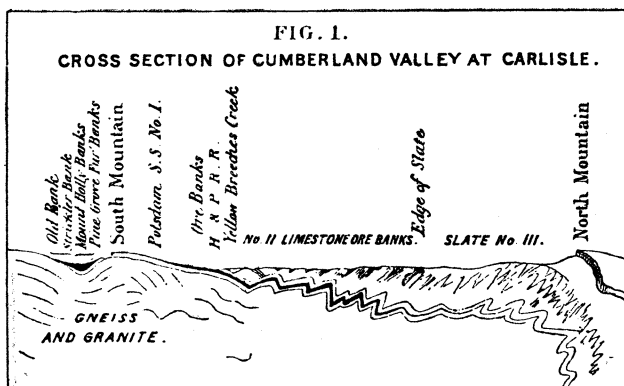
The Harrisburg and Potomac Railroad, starting from Harrisburg and running along the North base of the South Mountain, has for its objective point Shepherdstown on the Potomac, but its Western terminus has not yet been absolutely determined. It follows the Yellow Breeches Creek along the North foot of the South Mountain in Cumberland County, Pennsylvania. It runs parallel to Cumberland Valley Railroad, and distant from it, on an average, from four to six miles.

The Cumberland Valley is divisible into two parts, or belts, the one being slate land, the other limestone land. The Cumberland Valley Railroad may be taken as the line of demarcation between these two belts of Lower Silurian outcrops, running as it does nearly along the northern and northwestern edge of the limestone land. The interval, therefore between the two railroads is all limestone land.

This limestone belt is full of nests, pockets and strips of brown hematite ore, some of them small, others large. They have been opened by the farmers in, at least, sixty places between Mechanicsburg and Cleversburg, a distance of thirty miles. Fifty-seven of these ore-diggings are marked upon the map which accompanies this paper. But the number of ore deposits is indefinitely great. Probably several hundred mines, great and small, might be opened. Those actually opened are mostly mere trial pits from which a few hundreds or thousands of tons of ore have been dug, at the convenience of the farmers, and sold to the small charcoal furnaces built at different times during the last half century. No scientific exploration has ever been undertaken to test their real size, width, length and depth; nor has any geological tracing of the deposits into each other been made. The whole may be considered unexplored ground. No geologist can doubt for a moment that large quantities of wash ore, clay ore, rock ore and pipe ore lie concealed under the surface soil of the fields.

Passing to the south side of the Harrisburg and Potomac Railroad the geologist finds himself on a belt of country of a different kind, full of deposits of brown hematite iron ore, belonging to another and older series. To make this clear, I must give an ideal cross-section of the valley and the mountains which bounds it on the north and on the south. See Fig. 1.

It will be seen from the diagram below that the geological formations Nos. I, II, III and IV, resting upon each other and forming the Lower Silurian system, crop out southward from under each other ; so that, No. IV sandstone forms the North Mountain ; No. III slate, the northern half of the valley ; No. II b. limestone, the southern half of the valley between the two railroads ; No. II a. calciferous sandrock, the foot slopes of the South Mountain south of the Harrisburg and Potomac Railroad ; and No. I, Potsdam slates and sandstones, the facing and top of the mountain, resting on massive gneiss rocks forming the body of the mountain.



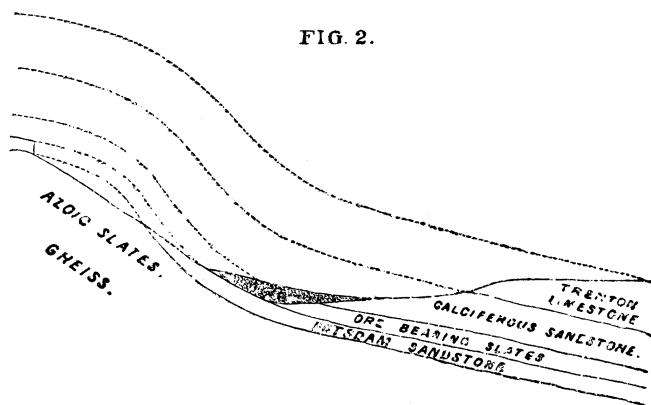
My object is to show that the ore deposits of the South Mountain face must needs be geologically *continuous*. For I have in other memoirs demonstrated that the ores are in fact nothing but the original rocks themselves from which all or nearly all the limestone has been dissolved out, leaving the clay, sand and iron behind. They are not washings of ore from distant regions, dumped down at hazard in hollows of the surface and therefore of uncertain occurrence and quantity. They are perfectly well-defined and continuous strata, occupying the position they always occupied, and following the sides of the mountains, the course of the principal stream, and the strike of the harder limestone ledges, along the whole course of the valley.

They never occur in any other relationships. They are the same ores, in the same rocks, arranged in the same way, the whole distance from Massachusetts to Alabama. Consequently, whatever is geologically true of the ore beds at Salisbury and Armenia east of the Hudson ; at Balliot's, Trexlertown and Moselem west of the Lehigh ; at Mont Alto and Antietam north of the Potomac ; at Embreeville in East Tennessee ; at Shelbyville in Alabama ; is equally and in the same sense and for the same reason true of the Old Bank, &c. at Boiling Spring, the Big Pond, Clever's and other banks along the line of this Harrisburg and Potomac Railroad in Cumberland County, Pa.

I. *As to their situation.* This belt of deposit runs along at the foot of the mountain slope, rising upon it in one direction (south) and sinking in the other direction (north) beneath the Yellow Breeches Creek and the limestone country north of it. But although there is a continuous belt of ore, the thickness of the deposit varies from mile to mile ; as also does its width upon the surface.

Formerly the slates which held the iron which mouldered into ore, rode up on the side of the mountain in a continuous sheet, resting on the great Potsdam Sandstone rock which is seen still resting upon the mountain in places forming peaks and plateaux upon its side and summit. But

FIG. 2.



great erosion has taken place, and in this erosion the slates have suffered most, because of their soft, clayey nature, and because they contained a large percentage of soluble limestone with the oxidizable iron. The above diagram will show how this has been accomplished : See Fig. 2.

As the erosion went on, the oxidized iron slipped with the heavy clays slowly downwards, the whole mass pressing upon itself and crimpling as it slid. The corrugations thus produced are visible in all the ore-banks.

Some of the strata in the slate formation were more clayey ; others more sandy. Some held more iron ; others less. Hence we see great masses of white clay parting the masses of ore in all the banks. We see in one part of a bank wash ore ; in other parts solid ore. Hence also we find in one place ore made cold-short by an overplus of silica (?) ; in another place a red-short ore due to an overplus of lime holding sulphurous traces ; in others a surplus of manganese ; in others again the ore is neutral. All these variations are due to differences of original compo-

sition in the different strata of the slate formation. And these variations follow the outcrops along the foot of the mountain in a waved line riding up its side or sinking into the plain.

The above description is true of the whole range along the foot of the mountain from Papertown westward to Cleversburg, and on into Maryland. But east of Papertown the mountain begins to sink into the plain of the Susquehanna River. The slate formation laps around its end and runs up behind its first ridge, carrying, of course, the ores with it. To explain this I must describe the structure of the mountain mass.

The South Mountain is not one mountain, but a system of parallel mountains separated by valleys. It is, geologically considered, a system of anticlinals with troughs between.

The first or northernmost anticlinal comes to an end (eastwardly) west of Papertown.

The second anticlinal begins to sink after passing east of Papertown. And it carries down with it into the limestone plain the mountain east of Papertown.

The slates which carry the ore, once arching continuously over the top of the present mountains, descend into the interior valleys. This accounts for the great banks at Mount Holly, half a mile south of Papertown, and the ore banks along the whole line of the Mountain Creek as far as Pinegrove Furnace.

At the Strickler bank, marked 6 on the map, the ore is seen lying in a trough between two mountains; and the Potsdam Sandstone is seen descending *southward* from the top of the mountain and passing under the floor of the ore bank. And the ore continues eastward along the centre of the trough to the Old Bank. North of the Old Bank the limestones of the valley are seen dipping southward. The north dipping ore-slates follow the foot of the mountain eastward to the New Pitts (3 on the map) opposite Boiling Springs.

The third anticlinal here begins to sink eastward, and the slates and ores lap round its end and run up into the next trough to the south of it where we have the Beltzhoover and Red Banks (2 and 1 on map).

The fourth anticlinal runs on a mile or so still further east and in its turn dies down; the slates, limestones and ore lap round it and take up their regular position at the south foot of its mountain, giving us the Knaub and Wolf Banks (20 on the map). The fifth and most southern anticlinal dies down in front of Dillsburg, and the slates and ores lap round it as usual and give us the McCormick and Williams banks.

It appears then that the South Mountain Range ends eastward in a hand with five fingers. Its little finger, and the most northern one, ends at Papertown (or less than a mile to the north of it); the next finger ends at the Old Bank; the third, at Boiling Springs (or rather one mile east of that place); the fourth and longest of them all, at the mouth of Dogwood; and the fifth or most southern one, opposite (one mile west of) Dillsburg.

Around these fingers, the ore belt laps continuously and sends up troughs of ore between the fingers.

Such is the most general statement of the geology. I reserve details of geological structure for the close of this note : merely alluding here to the fact that any one possessing the key to the geology can perceive a perfect regularity in the apparent confusion of the deposits.

II. *The quantity of ore* in this belt depends on three considerations, all of them variable :

First : On the original charge of iron in the slate and calc-sand strata.

Second : On the dip of these strata as they descend from the side of the mountain.

Third : On the depth beneath water-level to which the mouldering decomposition of the strata and the peroxidation, concentration and crystalization of the iron has extended.

First. It is not to be expected that the slate formation as a whole was equally charged with iron everywhere. Consequently at some points along this belt (of 20 miles) a greater quantity of ore is to be expected, and a deficiency of ore in the intervals. It is probable however that workable quantities will be found on almost, if not on quite, every mile of the belt. In five or six parts of the belt ore exists in millions of tons. At no one point have scientific mining operations revealed more than a small portion of the actual length, breadth and depth of the ore. At some places the intervals between two large mines are evidently occupied by ore to the same extent as at the mines actually opened. It is safe, for instance, to consider the whole interval between the Old Bank and the Strickler Bank as a continuous deposit of ore.

Second. A steep dip narrows the outcrop of ore ; a gentle dip broadens it. At the new pits opposite Boiling Springs the dip is about 6° , almost that of the surfaces ; consequently, pits sunk anywhere on the gentle foot-slope of the mountain over a space 1000 to 1500 feet wide and from half a mile to a mile long, strike ore within five or ten feet of the surface (sometimes at the surface) and go down through it to an unknown depth, at least 25 feet.

Third. This dip, whether steep or gentle, carries the ore down northward under the Calciferous Sandstone in which the Yellow Breeches Creek has cut its course. How far the ores can be followed down, northward, under the bed of the creek toward the interior of the Great Valley, and whether or not shafts of 500 to 1000 feet sunk on the north bank of Yellow Breeches Creek would strike the slate formation in a decomposed condition, that is, in the form of clays holding iron ores, no one can tell until trial be made ; but there is every reason to believe that the ore mined at the surface, at the foot of the mountain, forms in quantity but a small portion of the whole production of ore to be got hereafter under the valley of the creek.

From these considerations, I judge that the quantity of ore attainable by proper mining operations has no easily assignable limit, and may furnish supplies for centuries.

The present survey was expressly limited to the iron ores on the line of

the Harrisburg and Potomac Railroad in *Cumberland County*, Pennsylvania; but the ore deposit is geologically continuous along the South Mountain from the Susquehanna to the Potomac and beyond.* In addition to numerous outcroppings and surface developments the ores have been long and extensively worked on the old Southampton Furnace property, three miles west of of Cleversburg, at Old Pond on the Caledonia estate opposite Chambersburg, at Mount Alto three miles east, at Mount Etna ten miles southwest of Waynesboro', and near Antietam Furnace on the Potomac.

III. *Details.* These will be understood by reference to the following diagrams and to the accompanying map.

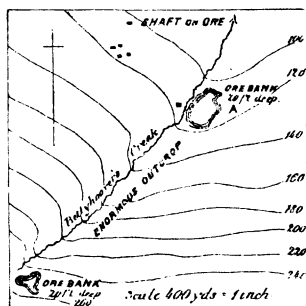
A. MOUNTAIN HEMATITES.—The most eastern point of development of these ores, on the line of the railroad, is on the property of the Carlisle Iron Works, about three miles east from Boiling Springs.

No. 1.† *Red Bank*—Lies $2\frac{1}{2}$ miles east 35° south from Boiling Springs, and is opened immediately on the bank of a good, never-failing stream, which would afford an abundance of water for washing, not only at this bank, but for a mile west. The opening is small, only a few tons of ore having been taken for testing at the furnace. The ore shows very red and full of fibrous brown hematite, like the Alabama ore, but with crystals only $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{1}{2}$ inch long, radiating and a little curved. The cavities are small, and lined with fibrous crystalline walls.

The quality of the ore is reported very good, producing, without admixture, a neutral iron.

No estimate can be made of the mass of ore here, as the opening has only gone down a few feet in the anhydrated (blood red) top-wash ore. The opening is 190 feet by barometer above the Yellow Breeches Creek, at the bend at Hoffer's, north of the bank.

FIG. 4.



No. 2. The exposure here consists of two old ore pits, marked A and B, on the accompanying sketch, Fig. 4, and some trial shafts. The banks lie 2 miles east 45° south from Boiling Springs, and one-half mile west of Red Bank, No. 1.

Pit A shows an opening of about 80 yards in length, by 18 to 20 yards in width, and from 7 to 8 yards in depth. Pit B is small, showing an opening about $20 \times 10 \times 7$ yards.

The banks lie upon the side of Beltzhoover's Creek, a small, scantily-fed stream, now entirely dry. All the way up the creek, from A to B and beyond, are lumps and masses of splen-

* See my description of the Palo Alto mines in Proceedings of the American Philosophical Society, Vol. X, p. 453, ff. Dec. 1864.

† These numbers refer to points so numbered upon the accompanying map, and not to any local nomenclature.

did ore, some of great size. At both banks the lumps and wash ore reach from within two or three feet of the surface to the bottom, a distance of 20 feet. The bottom in both banks is solid ore. Much white clay, creeping down hill, covers the ore, and is covered by ball and wash ore. The contour lines on the sketch show a fall of 140 feet from Pit B to the trial shafts, giving a gentle dip of 4° to 5° to the northward. The ore is struck in every case close to the surface, and has the same dip. In Pit B the ore is especially marked by the great abundance of needle ore.

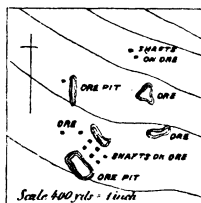
All the ore taken from these pits has been smelted at Boiling Springs Furnace, and is highly commended.

Over ten thousand cubic yards of excavation have been made at the two pits, yielding, after allowing for the dry and thinner wash-ore near the surface, some 15,000 tons of ore. As the solid ore in the bottom has never been worked through, it is impossible to estimate the mass of ore in sight.

Pit B is 240, and Pit A 120 feet above the Yellow Breeches Creek. Beltzhooover's Creek would afford but a scanty and insecure supply for a washer, but water could readily be brought from the Red Bank Creek, the difference in height by barometer being about 70 feet, and the distance, as paced between Red Bank (No. 7) and Pit A, one-half mile.

No. 3. This exposure consists of some small, old pits and a few trial shafts put down only until the solid ore was reached about $1\frac{1}{4}$ miles south 35° east from Boiling Springs, see Fig. 5. The pits and shafts are shallow, showing in the deepest from 15 to 18 feet wash and lump ore, with ore in the bottom. The ore is struck everywhere near the surface, and the dips would therefore be, as shown by the contour lines, 4° to 5° to the northward. The ore was used at the Boiling Springs Furnace, and was satisfactory. The total amount of excavation in these small pits will not exceed 3500 cubic yards, or 5000 tons of ore. Water for washing would have to be brought or pumped, there being no stream running by the banks. The most southern and highest bank is 150 feet by barometer above the Yellow Breeches, at Hoffer's Bend.

FIG 5



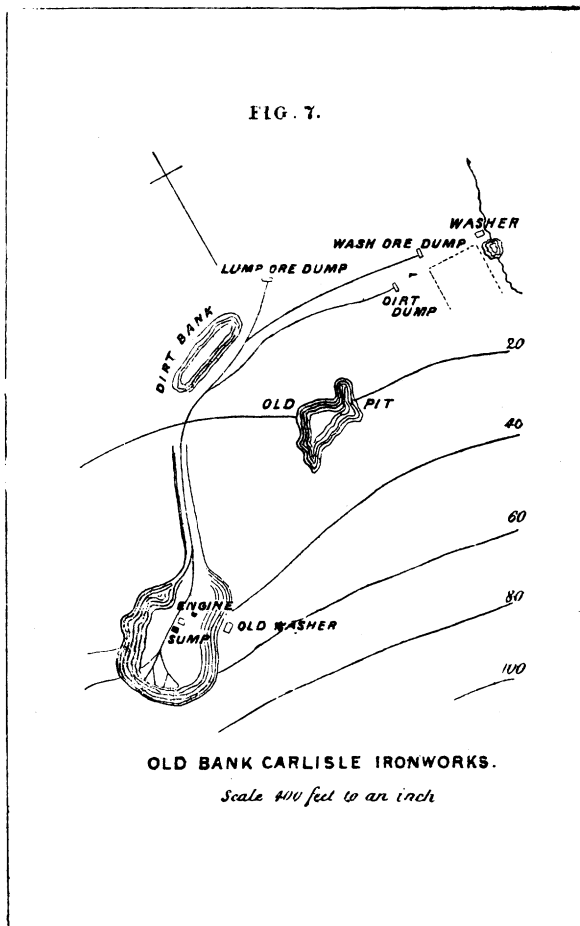
No. 4. *Siplinger Bank*—Lies $1\frac{1}{4}$ miles south of Boiling Springs, on the bank of a small stream amply sufficient for washing. The bank has not

FIG 6.



been worked for many years, and the sides falling have nearly filled it up. The wash ore is deep red, and the bank closely resembles in general appearance the Red Bank, No. 1. It is impossible now to judge the number of cubic yards of excavation made, but probably 2000 tons of ore have been hauled to the Boiling Springs Furnace, where it worked well. A poor exposure in the bank shows thus: (Fig. 6.)

No. 5. *Old Bank*.—Lies $2\frac{3}{4}$ miles south 18° west from Boiling Springs, on the edge of good and sufficient washing stream. The bank is now worked, and makes a large excavation. The rough sketch in Fig. 7, shows the size of the bank, depth, tramroads, washer-engine, etc. The main hole is 70 feet below the surface at its southern end. The floor is solid ore, and on the south face shows a beautiful arch of ore. In



addition to these 70 feet of wash and lump ore in sight, the dump has been sunk 28 feet through ore, leaving solid rock ore still below, making a total of 100 feet.

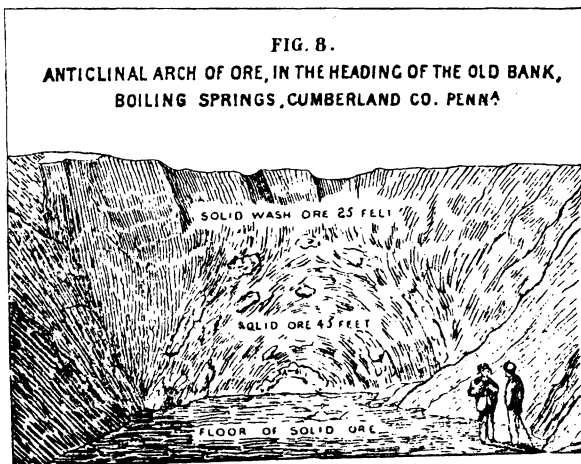
The quality of the ore is very high. It is used at Boiling Springs Furnace in the proportion of 75 to 85 per cent. to 15 to 25 per cent. of lime-

stone hematites, or magnetic ores. The iron made is of the finest quality, and when made into blooms at the forge attached to the furnace commands the highest market price. During the war the metal was tested at Knapp's foundry near Pittsburgh, and was found excellent for gun metal. The excavation at the Old Bank shows about 40,000 cubic yards, or 60,000 tons of ore removed. From the long-abandoned pit just east of the bank, the depth of which could not be measured, as the pit was full of water, some 15,000 to 20,000 cubic yards, or 25,000 to 30,000 tons of ore, seem to have been taken out.

All these openings, from the Red Bank, No. 1, to the Old Bank, No. 5, are on the property of the Carlisle Iron Works, the boundary line of the tract (10,000 acres) being marked on the map. A charcoal furnace, attached to the property, has been running for nearly eighty years, fed by ores from these banks above mentioned, with slight admixture of magnetic or limestone ores. Probably 150,000 tons of this mountain hematite have been mined from their banks for their furnace.

This furnace property now known as "Carlisle Iron works," and belonging to C. W. and D. V. Ahl, was formerly owned and for many years worked by Michael Ege. The furnace has been lately extensively improved with new hot-blast and blow-house, additional tuyere, increased blast, &c., and the weekly production of metal raised to 45 or 50 tons.

The power is entirely water, supplied in abundance by Yellow Breeches Creek and a group of powerful springs on the property.



The development at the Old Bank is sufficient to enable estimates to be made of ore in sight along the range. Taking a prism of ore from the Old Bank to the Strickler Bank (No. 5 to No. 6), nearly a mile west, and assuming less than one-half the thickness of ore showing at the Old Bank, 15 instead of 33 yards, we have $1600 \times 15 \times 1 = 24,000$ cubic yards, or

36,000 tons of ore for every yard driven back southward on the mountain. For a depth of 100 yards back, which is the depth now at the Old Bank, we have $24,000 \times 100 = 2,400,000$ cubic yards, or 3,600,000 tons of ore as the product of a bank reaching from the Old Bank to the Strickler, running back 100 yards, and cut down from top to bottom through 15 yards of lump and wash ore. But there is no reason why this prism should not be extended to the eastward as far as the ore is proved, say to Red Bank No. 1, the distance along the course of the ore being just five times 1600, or 8000 yards; and reducing the estimated thickness to $22\frac{1}{2}$ feet for security, we have $3,600,000 \times \frac{5}{2} = 9,000,000$ tons, a practically indefinite amount with only 100 yards extension into the mountain. There is, of course, no reason for fixing 100 yards as the limit, except for purposes of computation. After these figures it is scarcely necessary to compute the probable mass of ore sweeping eastward from the Red Bank (No. 7) around the eastern end of the South Mountain to the Knaub Bank.

No. 6. *Strickler Bank.*—Lies three miles south 32° west from Boiling Springs. Sketch, Fig. 9, exhibits the relative size of the bank, machinery for working, etc., and cross-section Fig. 10, shows the 20 feet of lump and wash-ore now being worked. In addition to this, the Superintendent states that the sump, 26 feet deep, was sunk entirely through ore, having solid ore in bottom. The present excavation shows

FIG. 9.
STRICKLER BANK.

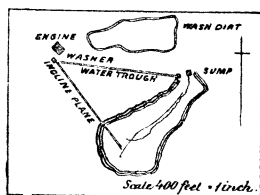
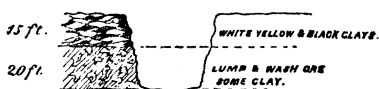


FIG. 10.
SECTION IN STRICKLER BANK.



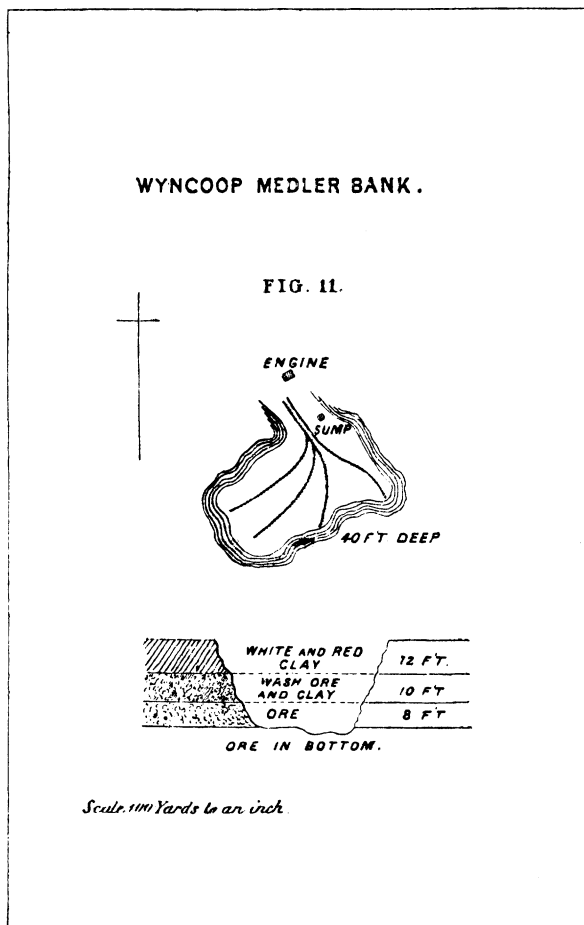
about 12,000 cubic yards, or 16,000 to 18,000 tons of ore removed; 18 tons of ore a day are now being shipped. The bank has water to wash 75 or 80 tons a day, but not machinery.

No. 7. *Papertown Banks.*—Two ore banks are opened here, and are now being worked. They lie just inside the Papertown Gap. The southern of the two—the Wyncoop-Medler Bank—is roughly sketched in Fig. 11. Large quantities of manganese are in these beds.

The present working face of ore, as shown in the cross-section, gives 18 to 20 feet of wash and lump ore in sight, with ore in the bottom. This is at the southern and western sides. At the northeastern end the bottom of the ore is reached and the sump is not through ore. The dip is to the southward and very decided, the present bank going directly across the ore bed, the total thickness of which, vertically, must be very great. The operators are now shipping about 40 tons of ore a day. They

have machinery to wash 150 tons a day, but water only for from 40 to 60 tons a day as supplied at present.

The Northern, or *Kirkstlager* Bank is sketched in Fig. 12. It lies 175 yards northeast of the last. The section shows 16 to 20 feet of wash and lump ore, with ore in the floor. The dip of the ore is to the southward and the work is now running across and down the ore. The total thickness of

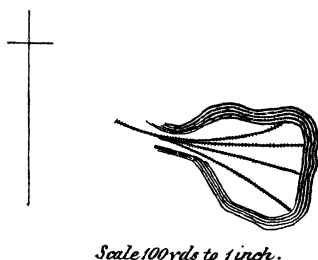


ore at this bank is very considerable. About 40 tons of ore a day are now shipped, but the amount is soon to be raised to 1000 or 1200 tons a month. Water for washing is pumped from Mountain Creek.

These ores are of good quality, going mostly to Harrisburg, where they are mixed half-and-half with Cornwall ore in the furnace.

The amount of ore already taken from these banks is about 25,000 cubic yards, or 37,000 tons from the Wyncoop-Medler Bank, and 20,000 cubic yards, or 30,000 tons of ore from the Kirkslager Bank. The ore bed being continuous up the valley of Mountain Creek for several miles, the amount of ore in sight is very great. Estimating the bed at six yards in thickness, which is only a small part of the vertical thickness showing at Papertown, the yield of ore would be 10,000 cubic yards, or 15,000 tons for each yard gone back on the bed, over a distance of one mile, cutting the bed 6 yards.

FIG. 12.



The cost of mining ore at these banks at the present time is thus stated :	
Royalty.....	75
Cost of mining and stripping.....	\$1 30
Hauling, washing and handling.....	15

\$2 20

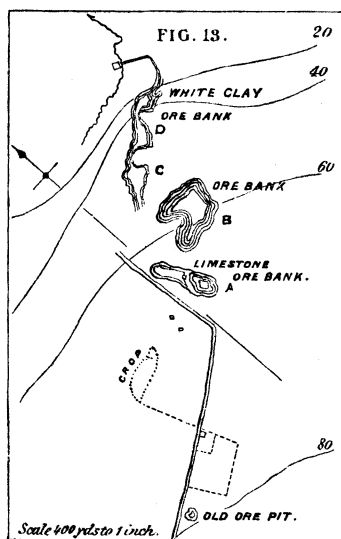
Price on the cars \$3.50 ; leaving a profit of \$1.30 a ton. When the price of ore is under \$3.00 a ton, royalty falls to 37½ cents a ton.

No. 8. One third of a mile east of Papertown, at the base of the South Mountain, a shaft has been put down on the ore ; it was reported as going 35 feet through ore. The ore, which was used at the Old Holly Furnace, was quite cold-short. On the Siplinger Place, a short distance north of this shaft, some ore had been taken from a shallow pit.

Nos. 9, 10, 11, 12, 13, 14. These are small, shallow, long since abandoned pits from which ore was hauled to Old Holly or Augusta Furnaces; or trial shafts sunk into solid ore. They lie at irregular distances from each other, close up against the South Mountain, in a line extending from Papertown Gap west 7 miles. The pits are almost entirely filled up and no estimates can be made from them.

No. 15. *Grove & Co.'s Banks*.—These banks lie close against the South Mountain, 1 mile south of the Yellow Breeches Creek, $6\frac{1}{2}$ miles south, 30° east from Newville. Augusta and Cumberland Furnaces ran many years mainly upon ores from these banks, which were extensively opened. They are now so completely fallen shut as to prevent any reliable estimates, but probably not less than 50,000 tons of ore have been taken from them. A great quantity of rich wash ore is now lying on their edges. The ore is reported to have worked well in the furnace, needing however considerable admixture of limestone ores.

No. 16. *Big Pond Banks*.—Lie 7 miles south of Newville, 5 miles east of Shippensburg, and a-half mile northwest from Big Pond Furnace. The accompanying rough sketch, Fig. 13, shows the position of the different openings, washer, &c.



The banks exhibit a series of openings, beginning at the northeastern end of the sketch, where the ore bottom is only a few feet above the level of the stream at the washer, running to the southwestern end of the sketch, where wash ore is struck in an old ore pit near the surface, 75 feet above the stream level. Only one bank is now worked (D), and the

others have washed in a mass of dirt which renders it impossible to see the actual ore depth mined out. The cross-section of D, Fig. 14, given below, is the present actual working face of ore (May). It shows 22 feet of clay overlaying 19 feet of wash and lump ore with clay in bottom not gone through. More recently the stripping has been only 6 feet with solid ore in bottom. The section of A, Fig. 15, shows limestone crop at the surface dipping south 20° east 8° , and how a shaft put down 20 yards south, went through ore and clays for 52 feet ending on limestone. The harder parts only of the limestone bed remain, the softer parts having worn away and been replaced by the ores and clays. The limestone is ferruginous and makes an excellent flux in the furnace.

FIG. 14

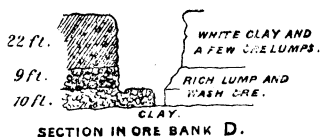
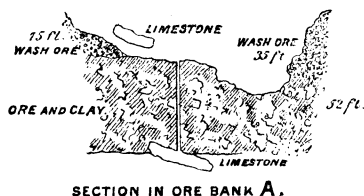


FIG. 15.



The ore is first rate in quality. It is and has always been used in the furnace just as taken from any of the banks, without any admixture of other ores. It makes a neutral iron which has always commanded the highest market price.

The quantity of ore removed from the banks is probably altogether not less than 75,000 to 90,000 tons. The furnace has been running steadily, excepting short intervals, from 1836 to 1868, making an average of perhaps 800 tons of iron a year. The ore needful for this amount of iron would correspond with the rough estimate of cubic yards removed now possible.

Assuming 21 feet or 7 yards as the thickness of the bed, every running mile will afford 12,000 cubic yards or 18,000 tons of ore for each yard mined back on the bed.

The Big Pond Furnace property, owned by P. A. Ahl, comprises about 6,000 acres of land. The furnace has recently been entirely renovated the stack being raised to 36 feet, with a new hot-blast, building, &c. Its capacity is now over 50 tons of charcoal iron per week.

No. 17. *Southampton Bank*.—Lies $1\frac{3}{4}$ miles east 15° north from Cleversburg, and $1\frac{1}{2}$ miles west 35° south from Big Pond Ore Banks. The mine is not now worked and the sides have fallen shut and the bottom become covered over. A poor exposure shows 8 feet of wash ore. This wash in sight, which was that nearest the surface, shows very lean with but few lumps. A heavy mass of white clay overlies the ore.

The ore taken from here was smelted at Franklin Furnace and is reported to work well.

No. 18. *Clever's Bank*.—Lies $1\frac{1}{8}$ miles east 30° south from Clevers-

FIG. 16.

CLEVER'S BANK.

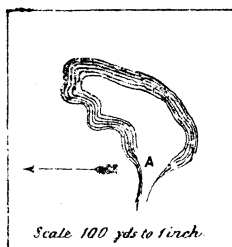
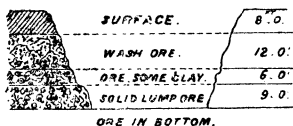


FIG. 17.



CROSS SECTION IN CLEVER'S BANK.

burg, on the bank of a stream sufficient for washing. The above rough sketch of the bank shows the present dimensions, Fig. 16.

Cross-section, Fig. 17, shows 27 feet of lump and wash ore, ore in the bottom, and represents the working face of ore on the eastern side of the bank. At A on sketch, on the western side of the bank, the ore bottom seems to have been reached and the underlying clay has not been pierced through. The present ore shipment is about 40 tons a day.

The ore goes to Harrisburg, Reading and Columbia and is reported very cold-short.

The bank shows that some 20,000 tons of ore have been removed. With the above depth of wash and lump ore 27 feet or 9 yards each running mile yields 15,000 cubic yards, or 22,000 tons of ore for each yard mined back into mountain and cut down to the bottom of the bed for that distance.

Considerable ore has been mined around Cleversburg, the Chestnut and Coffee Banks southeast of the town having been extensively worked.

With reference to the general quantity of ore along the line of the Harrisburg and Potomac Railroad from Dogwood Run on the east to Cleversburg on the west, the above detailed estimates made at each point where the development was sufficient, are enough to show that the amount is indefinitely great, and render any further figures unnecessary.

The quality of the ore varies very much. At the eastern end the ores taken from banks (1) to (5) inclusive, used at Boiling Springs Furnace, are very slightly cold-short, permitting the use of 75 per cent. of these ores to 25 per cent. of magnetic or limestone ores.

At Papertown (No. 7) the ores are more cold-short, 50 per cent. being used in the furnace.

At Big Pond (No. 16) the ores are neutral and are used unmixed.

At Clever's Bank (No. 18) the ores are reported to be quite cold-short.

Messrs. Grove & Co., of Danville, however, who have used these ores, state that they worked well when mixed with other ores and made a fine foundry iron. Messrs. Wister of Harrisburg have also used them.

A general examination of the past and present working of the furnaces running upon these mountain ores shows that it takes about $2\frac{1}{2}$ tons of ore to make a ton of metal. 130 to 140 bushels of charcoal may be put down as the average of fuel required.

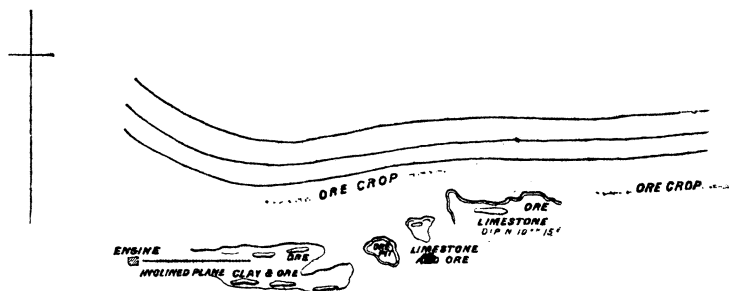
B. LIMESTONE ORES.—As shown on the map, these limestone hematites have been examined in many places. The show consists in most places either of a very heavy outcrop or abandoned shallow pits from which ore had been taken in quantities ranging from 100 to many thousand tons. Some of the localities are now in working. The description of them all would be mere repetition; one sketch, Fig. 18, will serve as a type of their character.

No. 19. *Gutthart Bank.*—Lies $3\frac{1}{2}$ miles east 20° south from Newville.

As shown in the above rough sketch, the working is done in a crevice, the limestone shutting in on both sides. The bottom of the ore-bearing clay has not been reached. At present about 12 to 14 tons a day are shipped. Water is pumped for washing.

At Cressler's Bank, 2 miles southeast of Shippensburg, there is a large excavation showing that probably 20,000 tons have been removed. It was abandoned on account of water. Mr. Cressler says that the ore did *not* lie regularly bedded with the limestone; and that when the water drove him out he was working 35 feet of pipe ore.

FIG. 18.



Scale 100 Yards to 1 inch.

On the Gorgas farm, near Bridgeport, on the Susquehanna, a limestone ore bank was extensively worked.

These ores, from their uniformly good quality and value for mixing with cold-short ores, are in great demand and readily bring \$5 or more a ton. But the uncertainty of the shape of the deposits and their size, the large amount of clay to be handled to each ton of ore, and the cost of pumping water for washing, or using the still more costly screener, these reasons prevent any great quantity of the ore from reaching the market even at the high price named above. A thorough development of these valley ores and the discovery of large regularly bedded deposits would change the whole character of the estimate of mining expenses.

III. YORK SPRINGS BRANCH RAILROAD.—A branch railroad leaves the Harrisburg and Potomac Railroad, near the mouth of Dogwood Run, and follows that stream around the eastern end of the South Mountain, running to York Springs Burrough formerly Petersburg in Adams County. This branch now under construction, therefore, reaches the mountain hematites on the South Mountain as well as the magnetic iron ores of York and Adams Counties.

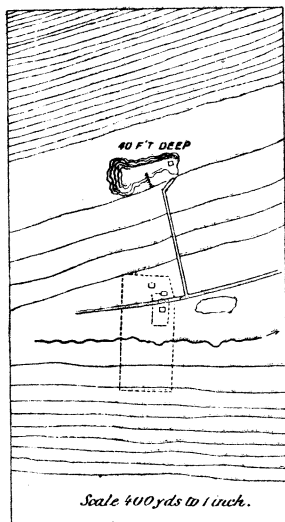
I. *Mountain Hematite. No. 20. Knaub Bank.*—Lies $2\frac{1}{4}$ miles west from Dillsburg. As shown by the rough sketch given below, the bank lies 80 feet above the stream which must supply water for washing. The proposed new line of the Harrisburg and Potomac Railroad passes within about $1\frac{1}{2}$ miles. The bank has not been worked for some time, and the

sides have fallen in. Fig. 19 shows 22 feet of lump and wash ore, with ore in the floor.

The excavation shows that some 25,000 cubic yards, or 35,000 tons of ore have been removed. About $1\frac{1}{2}$ miles west 20° south from the Knaub Bank the Wolf Bank is now being opened on the same terrace on the mountain side, immediately on the bank of the same excellent washing stream. Assuming the depth of ore showing at the Knaub Bank as persistent, we have between these two banks 6000 cubic yards or 9000 tons of ore for every yard mined north and south along the dip of the bed.

No. 21. *McCormick Bank*.—Lies about 2 miles west 35° south from Dillsburg, and half a mile from York Springs Branch Railroad. The bank has not been worked for some years, and the sides have slipped down.

FIG. 19.



The present face shows 10 feet of wash and lump ore, and a shaft from which ore was mined went down 16 feet in ore, making 26 feet. The ore was used in Harrisburg, and Mr. McCormick reports the quality very good. The amount of ore removed must have been quite large, as the bank was opened 60 years ago, and worked, with intervals of rest, up to 4 years ago. As the worked-out portions are filled with stripping and wash no estimate can be made of quantities. The dip of the ore is very decided, south 45° east, 25° . Mining has been done hitherto by running along the line of strike and going down the dip until the water

stopped work. The expense of hauling the ore 11 miles to Mechanicsburg on the Cumberland Valley Railroad, proved heavy, and the mine was for the time abandoned. Within a half mile south 15° west from McCormick's bank, there are two old banks from which considerable ore has been hauled in the past, but which are now fallen shut.

II. *Magnetic Iron Ores*.—The branch road strikes these ores about 1 mile east of Dillsburg. There appear to be five beds, the thickness of which is reported as follows :

- No. 1. Small. Most northerly bed.
- " 2. 3 feet.
- " 3. 5 to 12 feet.
- " 4. 4 to 7 feet.
- " 10 + feet.

The distance from No. 1 to No. 5 is from 800 to 900 yards. The beds dip north 20° . East and west along the strike of the beds for 300 to 400 yards, shallow pits have been opened on the beds, and ore taken out until the water stopped the work. These scattered openings extend over a considerable area, and, in the aggregate, much ore has been removed. At present (May) only one small pit is being worked—Mr. Underwood's. On Bed No. 3, Mr. McCormick of Harrisburg has mined a large amount of ore. He was provided with the necessary engine power and went down 80 feet, mining on slope along the dip of the ore. Gangways were then driven east and west in the ore. The expense of hauling 10 or 11 miles to Mechanicsburg rendered the works unprofitable, and the mine was abandoned and is now filled with water.

Two miles north of Petersburg in Adams County, on Lerew's place, there is an outcrop of magnetic ore. No opening has yet been made, but the place is leased and work is to begin at once.

Traces of magnetic iron ore have been found about half a mile south of Boiling Spring Furnace at the north foot of the South Mountain in connection with the trap dyke.

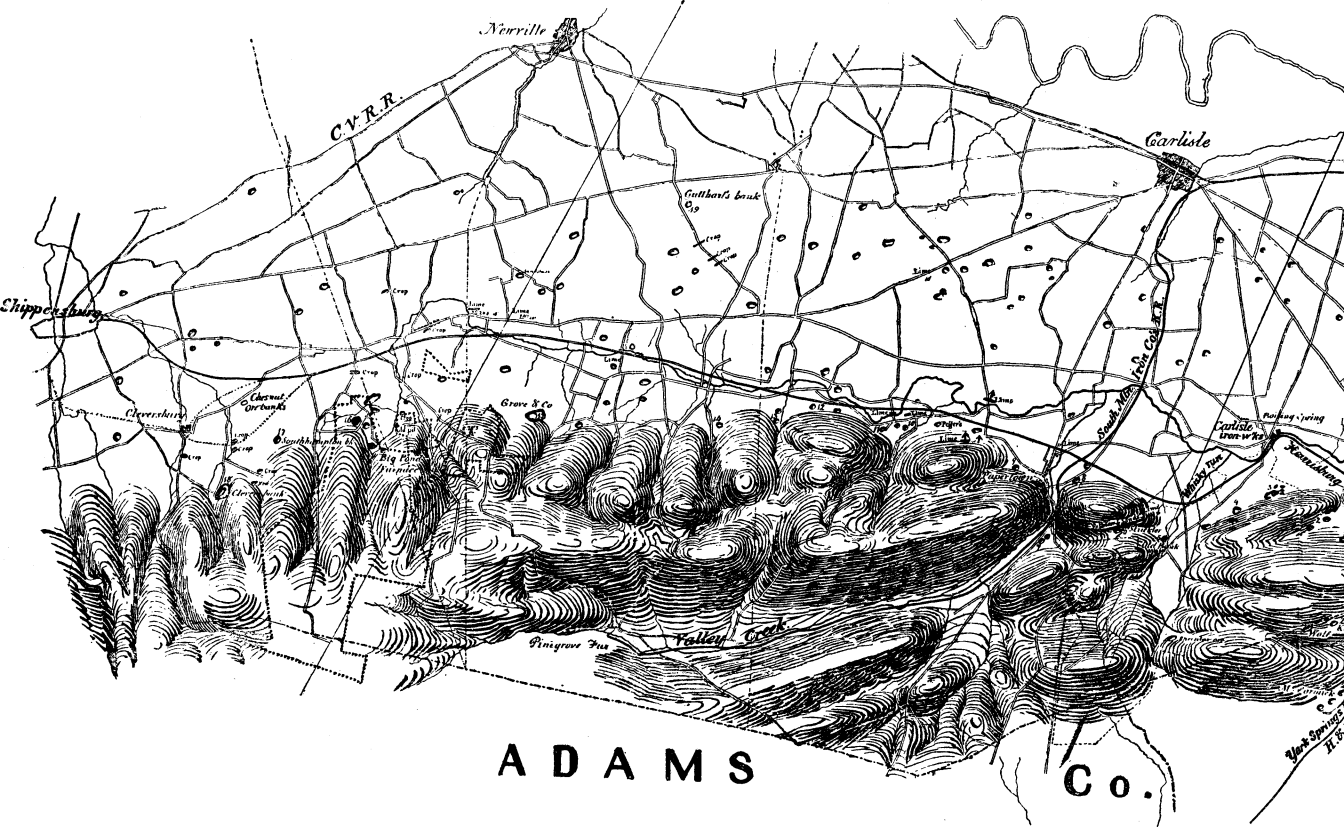
An outcrop of magnetic ore is found south of the Yellow Breeches Creek, running from the mouth of Dogwood Run east as far as Lower Milltown, on the Nelson, Nisely, Urich, Bishop, and Stayman farms. At Stayman's a pit has been sunk and the indications are reported as favorable.

One and a-half miles up Dogwood Run, specular iron ore crops at the surface. No opening has been made. An outcrop of specular iron ore is also found in the South Mountains, 4 miles south of Boiling Springs Furnace.

III. *Sand*.—At the mouth of Dogwood Run, an extensive flat is covered to a depth of 10 feet with a very pure sand. About 1000 tons have been shipped to Harrisburg for moulder's use. It is sufficiently valuable to bear a charge of \$2 for hauling and freight, and with cheap transportation by railroad, would probably be shipped in increased quantities.

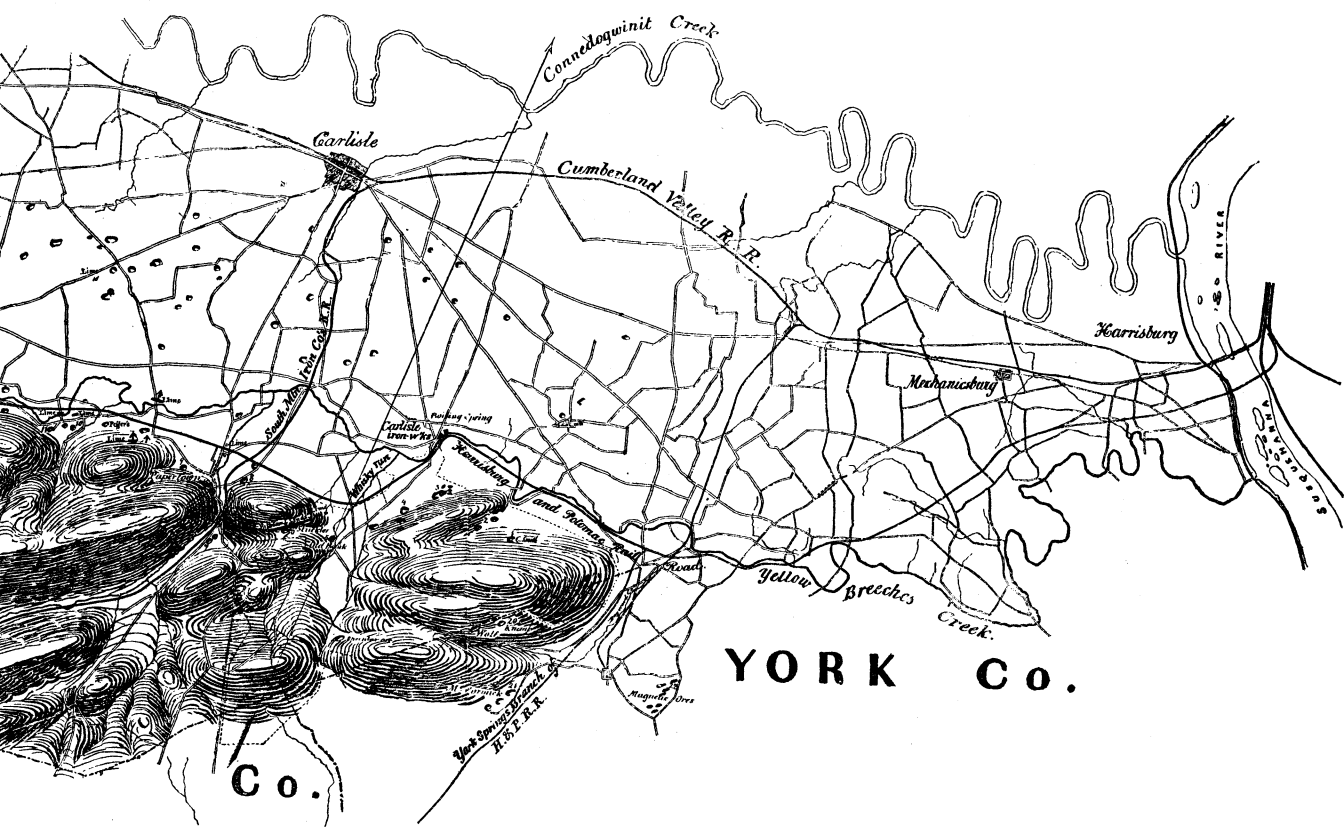
An excellent sand, suitable for furnace use, is opened at Boiling Springs Furnace. It lies between limestones somewhat altered, and comes from a friable altered sandstone. It is found on the "Trap-dyke Ridge." Good sands are opened at Papertown.

IV. *Limestone*.—The valley limestones, making usually the north bank of the Yellow Breeches Creek, are found along the whole line of the road; and are of all qualities ranging from burning to the hardest building stones. At Milltown, 8 miles east of Boiling Springs, 9 miles west of Harrisburg, the limestone is peculiarly excellent for burning, and about 100,000 bushels a year are now made there. The amount can, of course, be indefinitely increased with the enlarged market afforded by cheaper transportation.



A D A M S

C o .



Connetquot Creek

Carlisle

Cumberland Valley R. R.

Harrisburg

Mechanicsburg

Carlisle Iron Works

York Spring

York Spring Branch of H. & T. R.R.

Yellow Breeches Creek

YORK Co.

Co.